

Biological Evaluation of the

Crider Pine Project

Wayne National Forest, Ohio

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PROJECT LOCATION/DESCRIPTION

The Crider Pine Project Area is located 7 miles southeast of Oak Hill, Ohio, on Township Highway 344 (figures 1 and 2). The area consists of five pine plantations. Stands 1, 2, 4, and 5 are planted with white pine (*Pinus strobus*) and Stand 3 contains shortleaf pine (*Pinus echinata*). The majority of the Crider Pine stands were planted following acquisition of pastures and other open lands. Several of the stands (1, 2, & 4) were pre-commercially thinned in 1982.

Figures 1 and 2. Crider Pine Project, Ironton Ranger District, Wayne National Forest.



PROJECT OBJECTIVES

The objectives of this biological evaluation were to 1) assess the health of the pine stands, 2) assess current insect and disease activities within the stands, and 3) develop treatment alternatives and recommendations to reduce and/or control current and future insect and disease activity.

PROJECT METHODS

The guidelines used to evaluate current insect and disease population density and impacts include¹: 1) stand condition, 2) visual estimates of stand-level insect and disease densities, 3) visual estimates of individual tree insect and disease densities, i.e., insect emergence holes, pitch tubes, woodpecker activity, etc., and 4) visual estimates of tree condition.

There were five, 10 basal area factor prism plots, established in each stand. Twenty five plots for the entire area. Each plot was flagged and the center point GPS (global positioning system) position taken. All "in" trees had their species and D.B.H. (Diameter Breast Height 4.5") recorded. Each "in" pine tree's condition (Alive, Fading², Dead, Defects³, Live Crown Ratio, Insect Activity⁴) was also recorded. Light readings were recorded for each plot using the AccuPar LP-80 and compared to an instrument recording in an area with full sunlight. A representative dominant and co-dominant pine tree in each stand was increment cored and their heights recorded. Cores were mounted, sanded to make rings more visible and scanned using an Epson 1600 scanner.

¹ Forest Health Protection staff used signs and symptoms to tentatively identify insect and disease activity in stands.

² Fading trees have foliage that was off color, red or lime green and is a sign of tree stress.

³ Defects were most often multiple leaders, broken tops, multiple stems, or basal damage.

⁴ Insect activity was generally limited to pine bark adelgid.

The scanned images were examined using WinDENDRO 2006a to record number and location of rings. The data was analyzed using WinSTEM 2003d stem analysis software. This provided measurements of incremental diameter growth, cumulative diameter growth, incremental volume growth, and cumulative volume growth for each core. The text files produced by WinSTEM 2003d were imported into Microsoft Excel 2000 to create graphs comparing stands.

Figure 3. Plot Locations. Crider Pine Project, Ironton Ranger District, Wayne National Forest.



Figure 4. AccuPar LP-80 recording light measurements in area with full sunlight. Crider Pine Project, Ironton Ranger District, Wayne National Forest.



Figures 5 and 6. T. Elliott & N. Montoy performing data collection at the Crider Pine Project, Ironton Ranger District, Wayne National Forest.



PROJECT RESULTS

Stand #1

Stand #1 data revealed 231.43 ($\pm 10.25\%$ Standard Error) white pines per acre with 212 ($\pm 4.97\%$ SE) square feet of basal area per acre and an average D.B.H. of 13.0”.

Live white pine totaled 154.70 trees per acre with 156 square feet of basal area per acre and an average D.B.H. of 13.6”. The average L.C.R. (Live Crown Ratio) was 18.3% and 10% of the white pine showed pine bark adelgid (*Pineus strobe*) insect activity. Approximately 19% of the live white pine showed some defect. All defects recorded were multiple leaders with most occurring within the top 15 feet of the crown. An additional 76.7 trees per acre (33% of the white pine in the stand) with 56 square feet of basal area per acre represented the mortality in the stand. Tree species also found in the stand were black ash (6.8” average D.B.H.; 5% of total trees) and red maple (5.9” average D.B.H.; 18% of total trees). Regeneration observed in the stand consists of ash, boxelder, and beech. All regeneration was located near the edge of the stand or in openings created by dead trees. The average light meter measurements in the stand was 6.2 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) compared to 25.9 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) in the open.

Table 1. Summery of data for Stand #1, Crider Pine Project Area, Ironton Ranger District, Wayne National Forest, January 23-24, 2007.

Species	#Acre	Alive No Defect	Alive w/Defect	Total Alive	Fading No Defect	Fading w/ Defect	Total Fading	Dead No Defect	Dead w/ Defect	Dead Total	TOTAL	Trees with Insect Activity	Trees with No Insect Activity	Aver. Live Crown Ratio	Stand. Error	% Stand. Error	Coef. Var (%)
		For TOTAL															
BLACK ASH	#Acre	--	--	15.92	--	--	0.00	--	--	0.00	15.92	--	--	--	--	--	--
	% of all	--	--	100%	--	--	0%	--	--	0%	100%	--	--	--	--	--	--
	~D.B.H.	--	--	6.8	--	--	0.0	--	--	0.0	--	--	--	--	--	--	--
	BA	--	--	4	--	--	0	--	--	0	4	--	--	--	--	--	--
RED MAPLE	#Acre	--	--	52.71	--	--	0.00	--	--	0.00	52.71	--	--	--	--	--	--
	% of all	--	--	100%	--	--	0%	--	--	0%	100%	--	--	--	--	--	--
	~D.B.H.	--	--	5.9	--	--	0.0	--	--	0.0	--	--	--	--	--	--	--
	BA	--	--	10	--	--	0	--	--	0	10	--	--	--	--	--	--
WHITE PINE	#Acre	111.33	43.36	154.70	0.00	0.00	0.00	73.70	3.03	76.73	231.43	23.74	207.69	18.3%	--	--	--
	% of all	48%	19%	67%	0%	0%	0%	32%	1%	33%	100%	10%	90%		--	--	--
	~D.B.H.	13.3	14.2	13.8	0.0	0.0	0.0	11.8	11.0	11.8	13.0	--	--		--	--	--
	BA	106	46	158	0	0	0	54	2	56	212	--	--		--	--	--
TOTALS	#Acre	--	--	223.33	--	--	0.00	--	--	76.73	300.06	--	--	--	30.77	10.25	22.93
	% of all	--	--	74%	--	--	0%	--	--	26%	--	--	--	--	--	--	--
	BA	--	--	170.00	--	--	0.00	--	--	56.00	226.00	--	--	--	11.22	4.97	11.11

Stand #2

There are 168.40 ($\pm 18.07\%$ SE) white pines per acre with 190 ($\pm 5.77\%$ SE) square feet of basal area per acre and an average D.B.H. of 14.4”.

Live white pine totaled 139.03 trees per acre with 170 square feet of basal area per acre and

an average D.B.H. of 15.0". The average L.C.R. (Live Crown Ratio) was 14.3% and 6% of the white pine showed pine bark adelgid activity. Approximately 28% of the live white pine showed some defect. The defects consisted of multiple leaders (21%), multiple stems (5.3%) and broken tops (1.7%). Multiple leaders most often occurred within the top 15 feet of the crown.

Fading trees (on-going mortality) accounted for 5.66 white pines per acre with 4 square feet of basal area per acre and an average D.B.H. of 11.4". An additional 76.7 trees per acre (39% of the white pine in the stand) with 56 square feet of basal area per acre represented the mortality in the stand. Tree species also found in the stand were black ash (9.4" average D.B.H.; 4% of total trees), black cherry (16.9" average D.B.H.; 1% of total trees), and red maple (6.0" average D.B.H.; 25% of total trees). Regeneration observed in the stand consists of ash, boxelder, maple, beech, and hickory. All regeneration was located near the edge of the stand or in openings created by dead trees. The average light meter measurements in the stand was 12.8 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) compared to 74.6 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) in the open.

Table 2. Summery of data for Stand #2, Crider Pine Project Area, Ironton Ranger District, Wayne National Forest, January 23-24, 2007.

Species	#/Acre	Alive No Defect	Alive w/ Defect	Total Alive	Fading No Defect	Fading w/ Defect	Total Fading	Dead No Defect	Dead w/ Defect	Dead Total	TOTAL	Trees with Insect Activity	Trees with No Insect Activity	Aver. Live Crown Ratio	For TOTAL		
															Stand. Error	% Stand. Error	Coef. Var (%)
BLACK ASH	#/Acre	1	1	8.28	1	1	0.00	1	1	0.00	8.28	1	1	1	—	—	—
	% of all	—	—	100%	—	—	0%	—	—	0%	100%	—	—	—	—	—	—
	~D.B.H.	—	—	9.4	1	1	0.0	—	—	0.0	—	—	—	—	—	—	—
	BA	—	—	4	—	—	0	—	—	0	4	—	—	—	—	—	—
BLACK CHERRY	#/Acre	—	—	2.56	—	—	0.00	—	—	0.00	2.56	—	—	—	—	—	—
	% of all	—	—	100%	—	—	0%	—	—	0%	100%	—	—	—	—	—	—
	~D.B.H.	—	—	16.9	—	—	0.0	—	—	0.0	—	—	—	—	—	—	—
	BA	—	—	4	—	—	0	—	—	0	4	—	—	—	—	—	—
RED MAPLE	#/Acre	—	—	51.51	—	—	0.00	—	—	0.00	51.51	—	—	—	—	—	—
	% of all	—	—	100%	—	—	0%	—	—	0%	100%	—	—	—	—	—	—
	~D.B.H.	—	—	6.0	—	—	0.0	—	—	0.0	—	—	—	—	—	—	—
	BA	—	—	10	—	—	0	—	—	0	10	—	—	—	—	—	—
WHITE PINE	#/Acre	92.24	46.79	139.03	5.66	0.00	5.66	23.71	0.00	23.71	168.40	10.24	157.03	—	—	—	—
	% of all	55%	28%	83%	3%	0%	3%	14%	0%	14%	100%	6%	94%	14.3%	—	—	—
	~D.B.H.	14.5	15.6	15.5	11.4	0.0	11.4	11.1	0.0	11.1	14.4	—	—		—	—	—
	BA	106	64	170	4	0	4	18	0	18	190	—	—		—	—	—
TOTALS	#/Acre	—	—	201.38	—	—	5.66	—	—	23.71	207.04	—	—	—	41.69	18.07	40.40
	% of all	—	—	97%	—	—	3%	—	—	11%	100%	—	—	—	—	—	—
	BA	—	—	166.00	—	—	4.00	—	—	18.00	192.00	—	—	—	12.00	5.77	12.90

Stand #3

Stand # 3 consists mainly of shortleaf pine. There are 428.89 ($\pm 20.96\% \text{ SE}$) shortleaf pines per acre with 184 ($\pm 10.52\% \text{ SE}$) square feet of basal area per acre and an average D.B.H. of 8.7".

Live shortleaf pine totaled 348.19 trees per acre with 164 square feet of basal area per acre and an average D.B.H. of 9.3". The average L.C.R. (Live Crown Ratio) was 16.0%. No current signs of insect activity were detected in the stand. Approximately 8% of the live shortleaf pine showed some defect. The defects consisted of multiple leaders (4.5%), multiple stems (0.8%) and

broken tops (2.64%). Multiple leaders most often occurred within the top 15 feet of the crown. An additional 80.71 trees per acre (19% of the shortleaf pine in the stand) with 20 square feet of basal area per acre represented the mortality in the stand.

Tree species also found in the stand were black ash (12" average D.B.H.; .6% of total trees), sweetgum (12" average D.B.H.; 2% of total trees), and red maple (3.6" average D.B.H.; 20% of total trees). Regeneration observed in the stand consists of ash, boxelder, maple, oak, sweetgum, dogwood, beech and white pine. Regeneration was located throughout the stand, but was heaviest near the edge or in openings created by dead trees. Japanese honeysuckle (*Lonicera japonica*) is present and is most heavily located along the east side of the stand adjacent to James Road. The average light meter measurements in the stand was 23.9 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) compared to 75.7 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) in the open.

Table 3. Summary of data for Stand #3, Crider Pine Project Area, Ironton Ranger District, Wayne National Forest, January 23-24, 2007.

Species	#/Acre	Alive No Defect	Alive w/ Defect	Total Alive	Fading No Defect	Fading w/ Defect	Total Fading	Dead No Defect	Dead w/ Defect	Dead Total	TOTAL	Trees with Insect Activity	Trees with No Insect Activity	Aver. Live Crown Ratio	Stand. Error	% Stand. Error	Coef. Var (%)
BLACK ASH	#/Acre	--	--	2.55	--	--	0.00	--	--	0.00	2.55	--	--	--	--	--	--
	% of all	--	--	100%	--	--	0%	--	--	0%	100%	--	--	--	--	--	--
	~D.B.H.	--	--	12.0	--	--	0.0	--	--	0.0	--	--	--	--	--	--	--
	BA	--	--	2	--	--	0	--	--	0	2	--	--	--	--	--	--
RED MAPLE	#/Acre	--	--	86.58	--	--	0.00	--	--	0.00	86.58	--	--	--	--	--	--
	% of all	--	--	100%	--	--	0%	--	--	0%	100%	--	--	--	--	--	--
	~D.B.H.	--	--	3.6	--	--	0.0	--	--	0.0	--	--	--	--	--	--	--
	BA	--	--	6	--	--	0	--	--	0	6	--	--	--	--	--	--
SWEETGUM	#/Acre	--	--	7.64	--	--	0.00	--	--	0.00	7.64	--	--	--	--	--	--
	% of all	--	--	100%	--	--	0%	--	--	0%	100%	--	--	--	--	--	--
	~D.B.H.	--	--	12.0	--	--	0.0	--	--	0.0	--	--	--	--	--	--	--
	BA	--	--	6	--	--	0	--	--	0	6	--	--	--	--	--	--
SHORTLEAF PINE	#/Acre	312.45	35.74	348.19	0.00	0.00	0.00	80.71	0.00	80.71	428.89	0.00	428.89	--	--	--	--
	% of all	73%	8%	81%	0%	0%	0%	19%	0%	19%	100%	0%	100%	--	--	--	--
	~D.B.H.	9.3	9.6	9.3	0.0	0.0	0.0	6.7	0.0	6.7	8.9	--	--	--	--	--	--
	BA	146	18	164	0	0	0	20	0	20	184	--	--	--	--	--	--
TOTALS	#/Acre	--	--	444.95	--	--	0.00	--	--	80.71	444.95	--	--	--	110.57	20.96	46.87
	% of all	--	--	100%	--	--	0%	--	--	18%	100%	--	--	--	--	--	--
	BA	--	--	178.00	--	--	0.00	--	--	20.00	178.00	--	--	--	20.83	10.52	23.53

Stand #4

Stand #4 is predominantly white pine. However there were a few shortleaf pines recorded in the northeast corner of the stand.

There were 160.56 ($\pm 11.13\%$ SE) white pines per acre with 170 ($\pm 6.23\%$ SE) square feet of basal area per acre and an average D.B.H. of 13.9". Shortleaf pine in the stand numbered only 7.56 trees per acre (3.5% of all trees) with a basal area of 4 square feet and an average D.B.H. of 9.9" They are only located in the northeast corner of the stand.

Live white pine totaled 158.39 trees per acre with 168 square feet of basal area per acre and an average D.B.H. of 13.9". The average L.C.R. (Live Crown Ratio) is 22.3% and 7% of the white

pine showed pine bark adelgid activity. Approximately 25% of the live white pine showed some defect. The defects consisted of multiple leaders (17%), multiple stems (2.25%) broken tops (4.5%) and bole damage/rot (1.25%). Multiple leaders most often occurred within the top 15 feet of the crown. An additional 2.17 trees per acre (1% of the white pine in the stand) with 2 square feet of basal area per acre represented the mortality in the stand.

Tree species also found in the stand were black ash (17" average D.B.H.; .6% of total trees), red oak (16.7" average D.B.H.; 2% of total trees), and sweetgum (5.2" average D.B.H.; 19% of total trees). Regeneration observed in the stand consists of ash and sweetgum. All regeneration was located near the edge of the stand or in openings created by dead trees. The average light meter measurements in the stand was 11.7 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) compared to 62.6 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) in the open.

Table 4. Summary of data for Stand #4, Crider Pine Project Area, Ironton Ranger District, Wayne National Forest, January 23-24, 2007.

Species	#/Acre	Alive No Defect	Alive w/ Defect	Total Alive	Fading No Defect	Fading w/ Defect	Total Fading	Dead No Defect	Dead w/ Defect	Dead Total	TOTAL	Trees with No Insect Activity	Trees with Insect Activity	Aver. Live Crown Ratio	Stand. Error	% Stand. Error	Coef. Var (%)
		For TOTAL															
BLACK ASH	#/Acre	1	—	1.27	1	1	0.00	—	—	0.00	1.27	—	—	—	—	—	—
	% of all	—	—	100%	—	—	0%	—	—	0%	100%	—	—				
	-D.B.H.	—	—	17.0	—	—	0.0	—	—	0.0	—	—	—				
	BA	—	—	2	—	—	0	—	—	0	2	—	—				
RED OAK	#/Acre	—	—	5.25	—	—	0.00	—	—	0.00	5.25	—	—	—	—	—	—
	% of all	—	—	100%	—	—	0%	—	—	0%	100%	—	—				
	-D.B.H.	—	—	16.7	—	—	0.0	—	—	0.0	—	—	—				
	BA	—	—	8	—	—	0	—	—	0	8	—	—				
SWEETGUM	#/Acre	—	—	40.59	—	—	0.00	—	—	0.00	40.59	—	—	—	—	—	—
	% of all	—	—	100%	—	—	0%	—	—	0%	100%	—	—				
	-D.B.H.	—	—	5.2	—	—	0.0	—	—	0.0	—	—	—				
	BA	—	—	8	—	—	0	—	—	0	8	—	—				
SHORTLEAF PINE	#/Acre	7.56	0.00	7.56	0.00	0.00	0.00	0.00	0.00	0.00	7.56	0.00	7.56	14.0%	—	—	—
	% of all	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%				
	-D.B.H.	9.9	0.0	9.9	0.0	0.0	0	0.0	0.0	0	9.9	—	—				
	BA	4	0	4	0	0	0	0	0	0	4	—	—				
WHITE PINE	#/Acre	117.52	40.87	158.39	0.00	0.00	0.00	2.17	0.00	2.17	160.56	10.83	149.73	22.3%	—	—	—
	% of all	73%	25%	99%	0%	0%	0%	1%	0%	1%	100%	7%	93%				
	-D.B.H.	13.7	14.7	13.9	0.0	0.0	0	13.0	0.0	13.0	13.9	—	—				
	BA	120	48	168	0	0	0	2	0	2	170	—	—				
TOTALS	#/Acre	—	—	213.06	—	—	0.00	—	—	2.17	215.23	—	—	—	24.93	11.13	24.89
	% of all	—	—	99%	—	—	0%	—	—	1%	100%	—	—		—	6.23	13.93
	BA	—	—	188.00	—	—	0.00	—	—	2.00	190.00	—	—			12.08	

Stand #5

There are 406.33 ($\pm 18.12\%$ SE) white pines per acre with 256 ($\pm 11.13\%$ SE) square feet of basal area per acre and an average D.B.H. of 10.7".

Live white pine totaled 227.18 trees per acre with 184 square feet of basal area per acre and an average D.B.H. of 12.2". The average L.C.R. (Live Crown Ratio) was 15.4% and 16% of the

white pine showed pine bark adelgid activity. Approximately 12% of the live white pine showed some defect. The defects consisted of multiple leaders (6%), bole damage/rot (5%) and multiple defects (1%). Multiple leaders most often occurred within the top 15 feet of the crown. An additional 179.15 trees per acre (44% of the white pine in the stand) with 72 square feet of basal area per acre represented the mortality in the stand.

Sweetgum was found in the stand (4" average D.B.H.; 5% of total trees). Regeneration observed in the stand consists of ash, sweetgum and boxelder. All regeneration was located near the edge of the stand or in openings created by dead trees. The average light meter measurements in the stand was 7.0 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) compared to 47.2 ($\mu\text{mol m}^{-2}\text{s}^{-1}$) in the open.

Table 5. Summary of data for Stand #5, Crider Pine Project Area, Ironton Ranger District, Wayne National Forest, January 23-24, 2007.

Species		Alive No Defect		Alive w/ Defect		Total Alive	Fading No Defect	Fading w/ Defect	Total Fading	Dead No Defect	Dead w/ Defect	Dead Total	TOTAL	Trees with Insect Activity	Trees with No Insect Activity	Aver. Live Crown Ratio	Stand. Error	% Stand. Error	Coef. Var (%)
		Alive	No Defect	Alive	w/ Defect														
SWEETGUM	#/Acre	-	-	22.92	-	-	0.00	-	-	-	0.00	22.92	-	-	-	-	-	-	-
	% of all	-	-	100%	-	-	0%	-	-	-	0%	100%	-	-	-	-	-	-	-
	~D.B.H.	-	-	4.0	-	-	0.0	-	-	-	0.0	4.0	-	-	-	-	-	-	-
	BA	-	-	2	-	-	0	-	-	-	0	2	-	-	-	-	-	-	-
WHITE PINE	#/Acre	180.44	46.74	227.18	0.00	0.00	0.00	169.27	9.88	179.15	406.33	65.91	340.42	-	-	-	-	-	-
	% of all	44%	12%	56%	0%	0%	0%	42%	2%	44%	100%	16%	84%	15.4%	-	-	-	-	-
	~D.B.H.	12.0	12.8	12.2	0.0	0.0	0.0	8.5	10.8	8.6	10.7	-	-		-	-	-	-	-
	BA	142	42	184	0	0	0	66	8	72	258	-	-		-	-	-	-	-
TOTALS	#/Acre	-	-	250.10	-	-	0.00	-	-	179.15	429.25	-	-	-	77.78	18.12	40.52	-	-
	% of all	-	-	58%	-	-	0%	-	-	42%	100%	-	-	-	-	-	-	-	-
	BA	-	-	4.00	-	-	0.00	-	-	0.00	258.00	-	-	-	28.71	11.13	24.88	-	-

DISCUSSION

The lack of thinning in these pine stands have resulted in a situation in which natural or self thinning is occurring. This thinning is common in single species stand development and is the result of competition between trees for resources (light, nutrients, etc) and growing space. Stands in this stage of development have irregular waves of mortality separated by times of relatively little mortality of the remaining trees (Oliver and Larson 1996). It is this situation that has allowed the trees to become susceptible to insect attack. Although the insect species that are currently active in these stands, pine bark adelgid and bark beetles (mostly likely *Ips* or *Pityogenes* spp.) normally would not be considered as aggressive or tree killers. Large populations can build up when natural events, such as drought, windstorms, and competition create large amounts of susceptible (stressed) trees. The current condition of the white pine stands (high basal area, low live crown ratio) at the Crider project areas has allowed the stands to reach this stage of cyclical decline.

White Pine Stands #1, 2, and 5

Stand data for white pine in stands 1, 2, and 5 shows that mortality has been increasing for a number of years and is a result of stand composition, competition and stand and insect activity. The location of the stands on the stocking chart (figure 19 and 20), the difference between live and all trees, the leveling off of the diameter growth (figure 18) and low Live Crown Ratio (18.3%) displays the pattern of an overstocked stand. It is likely this trend of increasing mortality will continue as trees compete for resources and as insect populations take advantage of susceptible trees. This cycle will continue unless some corrective action is taken.

Figures 7 and 8. Regeneration and stand characteristics of Stand #1 (Plots 2 and 5 respectively). Crider Pine Project, Ironton Ranger District, Wayne National Forest.



The fact that these stands average approximately 20% defect shows damage from some agent in the past. We do not have enough information at this time to identify the cause of the damage. This damage could have been caused by insect, disease, environmental factors (ice, wind) or damage from the thinnings performed in 1982.

Figures 9 and 10. Regeneration and Stand Characteristics Stand #2 (Plots 4 and 5 respectively). Crider Pine Project, Ironton Ranger District, Wayne National Forest.



Regeneration observed in these stands consists of ash (1, 2, 5), beech (1, 2), boxelder (1, 2, 5), hickory (2), maple (2), and sweetgum (5). All regeneration was located near the edge of the stand or in openings created by dead trees. Light meter measurements show the stands average 80% darker than an open area outside the stand. The location of the regeneration in the stand and the light levels tend to suggest that the amount of light reaching the forest floor is having a major effect on regeneration.

Figures 11 and 12. Regeneration and dead trees in Stand #5. Crider Pine Project, Ironton Ranger District, Wayne National Forest.



White Pine Stand #4

The location of the stand on the stocking chart (figure 19 and 20), leads us to the belief that this stand's tendency is toward adequately stocked. However, the low live crown ratio of 15.4% and the flattening of the diameter growth (figure 18) present an image of a stand turning toward heavily stocked. This may be due to the thinning in 1982. It is possible that this stand was thinned more heavily, allowing for more growing space for the remaining trees. This could explain the low mortality (1%) despite the presence of insect activity (7%) and tree defects (25%). The defects in the stand show damage from some agent in the past. This damage could have been caused by insect, disease, environmental factors (ice, wind) or damage from the thinnings performed in 1982.

Shortleaf pine located in Stand #4 make up a small number of the total trees (3.5%) and are only located in the northeast corner of the stand.

Regeneration observed in the stand consists of ash and sweetgum. All regeneration was located near the edge of the stand or in openings created by dead trees. Light meter measurements show the stand was 82% darker than an open area outside the stand. The location of the regeneration in the stand and the light levels tend to suggest that the amount of light reaching the forest floor is having a major effect on regeneration.

Figures 13, & 14. Regeneration and Stand Characteristics Stand #4 (Plots 1, and 4 respectively). Crider Pine Project, Ironton Ranger District, Wayne National Forest.



Figure 15. Regeneration and Stand Characteristics Stand #4 (Center of the Stand). Crider Pine Project, Ironton Ranger District, Wayne National Forest.



Shortleaf Pine Stand #3

It appears that this mortality has been increasing for a number of years and is a result mainly of competition. The slowing of diameter growth (figure 18) and low Live Crown Ratio (16%) leads us to the belief that this stand is heavily stocked. Shortleaf pine is shade intolerant and does not compete well when suppressed. This may explain the slowing diameter growth in the stand. Shortleaf pine also tends to persist even though growth may decline. This trend will continue unless some corrective action is taken.

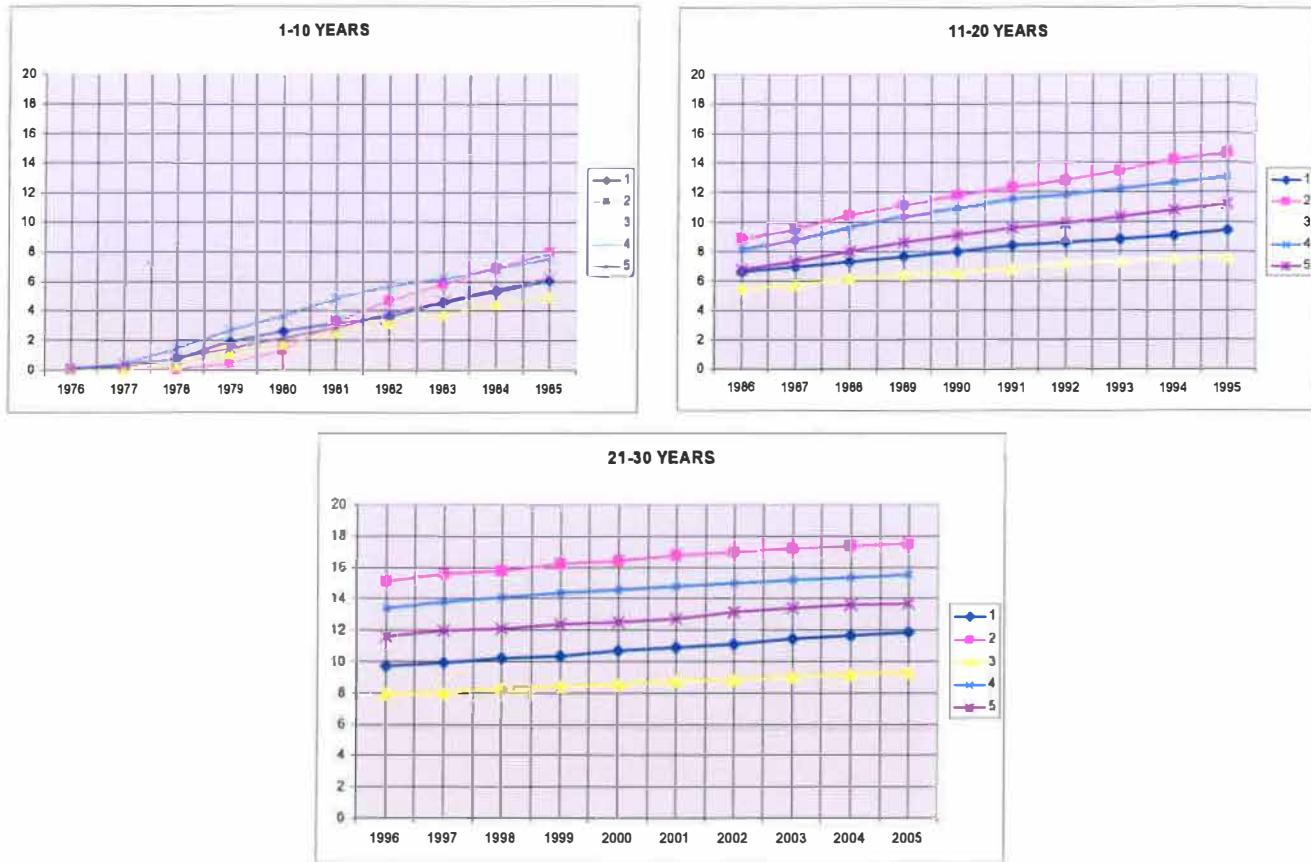
Regeneration observed in the stand consists of ash, boxelder, maple, oak, sweetgum, dogwood, beech and white pine. Regeneration was located throughout the stand, but was heaviest near the edge or in openings created by dead trees. This stand receives the most light compared to all other stands. Light meter measurements show the stand only 67% darker than an open area at the same time. This could account for the location and abundance of regeneration in the stand.

Japanese honeysuckle (*Lonicera japonica*) is present and is most heavily located along the east side of the stand adjacent to James Road. Stand treatments should take this into account. Vines can grow and spread rapidly when light levels are increased by disturbance. This could interfere with forest regeneration.

Figures 16 and 17. Regeneration and Stand Characteristics Stand #3 (Plots 1 and 2 respectively).
Crider Pine Project, Ironton Ranger District, Wayne National Forest.



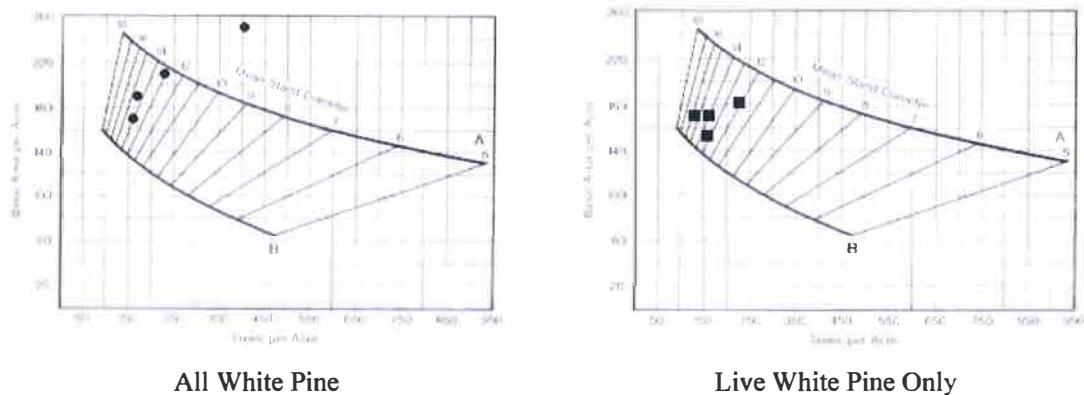
**Figure 18. Cumulative Diameter Growth for Stands based on Increment Cores of Dominant Trees.
Crider Pine Project, Ironton Ranger District, Wayne National Forest.**



The total age of the stands based on planting records is 35 years. After analyzing the increment cores, the average tree age at 4.5 feet above the base was approximately 29 years with a standard deviation of 1.3 years. The discrepancy in age is due to the period of time it took for the tree to reach 4.5 feet in height. Although different amounts of diameter and volume growth were present in each stand, they all exhibited a similar trend over time.

*Note the lessening diameter growth through years 21-30 as compared to the previous years. This is a probable indication that competition is becoming an issue in the stands.

Figures 19 and 20. Location of white pine stands on stocking chart. Philbrook, J. S., J. B. Barrett, and W. B. Leak. (1973) *Crider Pine Project, Ironton Ranger District, Wayne National Forest.*



This demonstrates the cycling of mortality and stand stocking. As stands meet or cross line "A" (representing 80 percent stocking, and stands above it are considered overstocked) mortality increases (through natural competition, environmental conditions, insects and disease). The stand thins itself and falls back to an adequate stocked condition. The cycle then repeats.

Figure 21 and 22. Photos of broken tops and double leader trees. Crider Pine Project, Ironton Ranger District, Wayne National Forest.



WHITE PINE STANDS (1, 2, 4, 5)

Management Alternatives

Five management options have been evaluated for the white pine Stands. The intervention options were evaluated based upon the following objectives: 1) reducing insect and disease in infested areas, and 2) improving the health of the stand.

Chemical control of adelgid is not recommended for these areas because: 1) trees need to be monitored regularly so that attacks can be detected and pesticide applied, 2) to be effective, treatments must target individual trees, and 3) these treatments do not address the underlying problem of stocking occurring in the stands.

Alternative 1: No Action.

This alternative is considered the environmental baseline (the no action alternative). Under this option, no silvicultural treatments are implemented and nature is allowed to run its course. The stands will remain stagnant and overcrowded with significant mortality continuing. Stands will remain highly susceptible to insect and disease outbreaks. Individual tree D.B.H. and crown growth will remain suppressed with growth expected to range from poor on the smaller-crowned trees to moderate on the larger-crowned trees.

Alternative 2: Clearcut all the stands and replant.

This approach would completely remove the current stand and begin again with an undesirable even-aged, single species stand susceptible to insect and disease outbreaks. It is very probable that undesirable hardwood species would take over and would interfere with the planted seedlings. Application of herbicide or controlled burning would be necessary to control the hardwoods until the planted seedlings become established. The appearance of the stand during this treatment could lead to negative feedback from the public.

Alternative 3: Implement a crown thinning.

Crown thinning removes trees from the intermediate, co-dominant and dominant crown classes. Removing overstory trees creates gaps that allow more light to penetrate the stand. Space is also freed for the growth of promising trees in the same classes. Selection is based on health, defects and growth potential. The trees that are healthier, defect free and have a greater probability of growth are retained. Trees having poor health, defects or are simply competing with other more desirable trees may be chosen for removal. Trees being retained should be cleared on at least three sides of the crown. This is done to provide for enough growing space for the remaining trees.

This would increase growth of remaining trees, encourage white pine regeneration and create an uneven-aged stand of mixed species. Established individuals often respond well to release. The average DBH will not change much after cutting, nor will the average height change very much. Only the basal area and number of trees will be reduced. Some windthrow and breakage may occur.

Alternative 4: Implement a row thinning by removing every third row, which would remove one-third of the trees per acre and one-third of the basal area.

This type of thinning is easy to implement, felling and removal of trees is also straightforward. This type of thinning would remove both desirable and undesirable trees (small D.B.H., small crown, defective, and low vigor) and will provide growing space for both desirable and undesirable trees. It is likely the trees that have been suppressed over the last several years will continue to die even after thinning. Accelerated crown and D.B.H. growth is likely on most of the trees in the stand. Some windthrow and breakage may occur.

Alternative 5: Implement a selective thinning by removing one out of every three trees in every row.

This would remove one-third of all trees. In each row, one tree would be removed from the first three trees, one from the next three trees, and so on, to the end of the row. The trees to be harvested would be the least desirable of the three (smallest D.B.H., smallest crown, insect or disease infested). This type of thinning would accelerate crown and D.B.H. growth on the most desirable trees in the stands by removing the least desirable trees. All the trees to be harvested would need to be marked. Felling and removal of the trees would be more difficult than in the row thinning. This type of thinning would increase individual tree vigor and the overall vigor of the stands. Some windthrow and breakage may occur.

Recommendations

Alternative 3 (crown thinning), Alternative 4 (row thinning) and Alternative 5 (selection thinning) would increase the overall vigor of the stands. Alternative 3 (crown thinning) and Alternative 5 (selection thinning) would accelerate growth on the more desirable trees in the stands but Alternative 5 (selection thinning) would be harder to implement than the crown thinning or row thinning because a conventional skidder may be too large to operate in the stands, making removal of the harvested trees difficult. Alternative 3 (crown thinning) and Alternative 4 (row thinning) would be easier to implement since there would be enough room in the stands to operate a skidder. Row thinning, however, would remove some desirable trees while leaving some undesirable trees. It is also likely that more mortality will occur after row thinning than after a crown thinning.

It is recommended that the Wayne National Forest decide in favor of Alternative 3 (crown thinning), which would likely provide the best results for individual tree health and overall stand health. Consideration may be warranted in regeneration of other favorable native tree species. Creation of a mixed species, uneven-age stand would provide further insurance against future insect and disease outbreaks. This type of stand is less susceptible to outbreaks of a single injurious agent. This can be done by allowing natural seeding or by planting. If regenerating white pine, thought should be given to keeping the crown closure to 40-50 percent. This will provide enough shade to discourage weevils and reduce blister rust infection, but allow enough light for adequate regeneration growth.

During harvesting operations great effort should be used to minimize the damage to remaining trees and roots by equipment and felling. It is also suggested that the presence of invasive plants be considered when treating the stand. The presence of Japanese honeysuckle has been noted and it could become an issue when trying to regenerate the stands.

SHORTLEAF PINE STAND (3)

Management Alternatives

Four management options have been evaluated for the shortleaf pine stand. The intervention options were evaluated based upon the following objectives: 1) reducing insect and disease in infested areas, and 2) improving the health of the stand.

Alternative 1: No Action

This alternative is considered the environmental baseline (the no action alternative). Under this option, no silvicultural treatments are implemented and nature is allowed to run its course. The stands will remain fairly stagnant and overcrowded and mortality will continue. The stands will also remain highly susceptible to insect and disease outbreaks. Individual tree D.B.H. and crown growth will remain suppressed with growth ranging from poor on the smaller-crowned trees to moderate on the larger-crowned trees.

Alternative 2: Clearcut the stand and replant.

This approach would completely remove the current stand and begin again with an undesirable even-aged, single species stand susceptible to insect and disease outbreaks. It is very probable that undesirable hardwood species would take over and would interfere with the planted seedlings. Application of herbicide or controlled burning would be necessary to control the hardwoods until the planted seedlings become established. The appearance of the stand during this treatment could lead to negative feedback from the public.

Alternative 3: Implement a crown thinning

Crown thinning removes trees from the intermediate, co-dominant and dominant crown classes. Removing overstory trees creates gaps that allow more light to penetrate the stand. Space is also freed for the growth of promising trees in the same classes. Selection is based on health, defects and growth potential. The trees that are healthier, defect free and have a greater probability of growth are retained. Trees having poor health, defects or are simply competing with other more desirable trees may be chosen for removal.

This would increase growth of remaining trees and create an uneven-aged stand of mixed species. Established individuals often respond well to release. Some windthrow and breakage may occur.

Alternative 4: Implement a row thinning by removing every third row, which would remove one-third of the trees per acre and one-third of the basal area.

This type of thinning is easy to implement, felling and removal of trees is also straightforward. This type of thinning would remove both desirable and undesirable trees (small D.B.H., small crown, defective, and low vigor) and will provide growing space for both desirable and undesirable trees. It is likely that the smaller trees that have been suppressed over the last several years will continue to die even after the thinning. Accelerated crown and D.B.H. growth is

likely on most of the trees in the stand. Some windthrow and breakage may occur.

Recommendations

Alternative 3 (crown thinning) and Alternative 4 (row thinning) would increase the overall vigor of the stand. Alternative 3 (crown thinning) would accelerate growth on the more desirable trees. Alternative 4 (row thinning) would remove some desirable trees while leaving some undesirable trees. It should be noted that regeneration of Shortleaf pine can be difficult due to its shade intolerance and slow growth. Regeneration of Shortleaf pine will require control of competing species.

It is recommended that the Wayne National Forest decide in favor of Alternative 3 (crown thinning), which would likely provide the best results for individual tree health and overall stand health. Consideration may be warranted in regeneration of other favorable native tree species. Creation of a mixed species, uneven age stand would provide further insurance against future insect and disease outbreaks reducing their impact on the stand. This can be done by allowing natural seeding or by planting.

During harvesting operations great effort should be used to minimize the damage to remaining trees and roots by equipment and felling. It is also suggested that the presence of invasive plants considered when treating the stand. We have noted the presence of Japanese honeysuckle in the area and believe this could become an issue when trying to regenerate the stand.

ADDITIONAL INFORMATION

Pine Bark Adelgid

Species: *Pineus strobi* (Hartig)

Distribution: North America and Europe

Hosts: Mainly attacks eastern white pine but can infest Scotch, Ponderosa, jack and pitch pines.

Damage: Heavy infestations on branches of pines will cause stunted growth. Foliage may become blackened from a fungus growing on the honeydew and wax produced by the nymphs and adults. Occasionally even tree death may occur. This pest usually does not attack smaller trees.

Description and Life Cycle: This pest is often called an aphid though adelgids do not have the long antennae and cornicles typical of aphids. The life cycle of the pine bark adelgid is not well understood. Apparently, immature females overwinter attached to the bark of pines. When the spring temperatures reach 50F, these nymphal females become active and are soon covered with a white woolly wax. By late April, the nymphs mature and molt into wingless adults. These females lay 40 to 50 eggs in 20 to 30 days. The eggs hatch in one to two weeks and the crawlers move to suitable places on the tree to insert their mouthparts. They often hide under old dead adults on the bark, at the bases of old needles and under newly emerging needles. The new nymphs produce waxy coverings and take about 20 to 30 days to mature. This pest may have up to five overlapping generations in a season with adults, nymphs and crawlers present throughout the summer. Adults and young nymphs apparently die during the winter; only the nymphs which have molted twice, third instars, can overwinter.

Control Hints: This pest is slow to spread because the crawlers have to drop from adjacent trees, be wind blown, or hitch a ride on birds or other animals found in the plantation. Older stands of white pines surrounding plantations should be removed.

Option 1: Biological Control - Encourage Natural Predators and Parasites - Many lady beetles, lacewings and hover flies attack the pine bark adelgid. These are usually not effective in Christmas tree plantations because of the use of insecticides sprayed for other pests. Be careful to not misidentify the lady beetle larvae which are often covered with white woolly material and look much like the adelgids.

Option 2: Chemical Control - Dormant Oil Sprays - Dormant oil sprays (3-5%) are quite effective if applied in the fall or spring to kill the overwintering nymphs. Be sure to spray in the spring before the females have begun to produce eggs in the waxy coating. Thorough coverage of the trunk and branches is needed.

Option 3: Chemical Control - Insecticide Sprays - Sprays using registered insecticides, applied in mid-April will kill the overwintering nymphs before they mature and lay eggs. Summer sprays are effective but two to three sprays, at weekly intervals, will be needed to kill new crawlers hatching from resistant eggs.

NOTE: Disclaimer - This publication may contain pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registrations, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The author and Ohio State University Extension assume no liability resulting from the use of these recommendations. All educational programs conducted by Ohio State University Extension are available to clientele on a nondiscriminatory basis without regard to race, color, creed, religion, sexual orientation, national origin, gender, age, disability or Vietnam-era veteran status.

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**Penn State College of Agricultural Sciences, Cooperative Extension, Entomological Notes,
Department of Entomology**

WHITE PINE WEEVIL

Pissodes strobi (Peck)

The white pine weevil is considered the most destructive insect pest of eastern white pine in North America. This species kills the terminal leader primarily of eastern white pine. Colorado blue spruce, Norway spruce, Scots, red, pitch, jack, and Austrian pines, and occasionally Douglas-fir are also attacked. Trees become susceptible to injury when they reach a height of about three feet. The white pine weevil prefers to attack trees exposed to direct sunlight.

DESCRIPTION: The adult is a small rust-colored weevil that is about 4-6 mm long (Fig. 1). It has irregularly shaped patches of brown and white scales on the front wings. Near the apex of the front wings is a large white patch. Like most weevils, the adult has a long snout-like beak from which small antennae arise. The larval stage, which lives beneath the bark, is white with a distinct brown head. When mature, the larva is approximately 7 mm long, legless, and slightly C-shaped.

LIFE HISTORY: Adults spend the winter in the leaf litter under or near host trees. On warm spring days they fly or crawl to the leaders of suitable hosts usually during the period from mid-March through April. Most feeding by adults is done within 25 cm of the terminal buds. From mid-April through early May, females mate and each deposits one to five eggs in feeding wounds. Hundreds of eggs may be deposited in one terminal leader. The eggs hatch in about seven days. When the terminal is heavily infested larvae feed side by side in a ring encircling the stem. They feed downward on the inner bark of the leader. Larvae reach maturity in mid- to late July and pupate in the infested terminal. The pupal chambers called "chip cocoons" are filled with shredded wood and can be found inside the terminal at this time. Adults emerge in 10 to 15 days through small holes at the base of the dead terminal of the host plant usually in late July and August. During this time feeding by adults is not considered important since little is done before they enter the leaf litter to overwinter. The white pine weevil has one generation per year.

DAMAGE: The first symptom evident from attack by the white pine weevil is glistening droplets of resin on terminal leaders in late March and April. This is the result of punctures made by adults in the process of feeding and cutting egg-laying sites. Injury to eastern white pine and spruce is usually confined to the previous year's terminal leader. Damage on Scots pine often extends downward through two or three year's growth. Infested trees are seldom killed. Most damage is done by the larval stage. Larvae are found just under the bark of infested terminals from May through July. Larvae chew and burrow completely around the stem causing the current year's growth to wilt, droop, and eventually die. One or more side branches (laterals) may then bend upward to take over as the terminal leader. At this point the tree is now permanently crooked. For several years after successful attack by this pest, a few more laterals may grow as leaders. This condition may result in a forked tree.

MANAGEMENT: Eastern white pine is most attractive to this pest when trees are less than 20 feet in height. In July look for curled, dead, or dying terminal leaders that may have the appearance of a "shepherd's crook." The infested leaders should be pruned and burned before mid-July to destroy life stages of this pest. Cut back all but one live lateral shoot just below the damaged terminal. This should promote single stem dominance on the affected host plant. Observations of resin droplets on the leader in early spring may be an indication that adults are feeding. Application of a registered formulation of an insecticide should be made from late March through April when droplets of resin are first detected. Only the terminal leader needs to be sprayed. Insect parasitoids and predators as well as birds feed on this pest. The effect of these natural enemies is not significant enough to prevent damage.

WARNING: Pesticides are poisonous. Read and follow directions and safety precautions on labels. Handle carefully and store in original labeled containers out of the reach of children, pets, and livestock. Dispose of empty containers right away, in a safe manner and place. Do not contaminate forage, streams, or ponds.

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White Pine Blister Rust - Revised

Kimberly J. Miller

Since its introduction into the United States in the early 1900s, white pine blister rust, caused by the fungus *Cronartium ribicola*, has progressively spread and is now considered the major introduced pathogen and most destructive agent of eastern white pine (5). It is capable of killing trees of all ages - generally the smaller the tree when infected, the more quickly it will succumb. Trees over 20 feet are more likely to suffer top dieback than mortality as a direct result of infection (5).

Other susceptible five-needle pines include limber pines (*Pinus flexilis*), mountain white pine (*P. monticola*), and sugar pine (*P. lambertiana*). Relatively resistant species include bristlecone, Swiss stone, and Himalayan blue pines (4).

White pine blister rust extends over much of the range of commercially important white pines in the United States. In the south it occurs along the Appalachian Mountains in West Virginia, North Carolina, Tennessee, and Georgia. Present throughout the northeast and west into Minnesota and Ohio, it extends from Alberta south into Idaho, western Montana, and southeastern Wyoming; and from British Columbia south into northern California (4).

In the mid-1980s blister rust was known to exist in several small timber stands in Pennsylvania (3). Even though horticulturists long recognized the potential for this rust to infect nursery stock, it was not detected until 1993 when it was found in a Wayne Co. nursery that grows mostly white pine. Although suspected at several other locations, it was not confirmed on pine until spring 1994 when four additional nursery locations, one in each of Carbon, Monroe, Wayne, and Wyoming counties were observed. In the 1993 and 1994 growing seasons blister rust was observed on the alternate host *Ribes sp.* in Carbon, Lackawanna, Pike, Susquehanna, and Wayne counties; however, the potential exists for it to be widespread in areas where conditions are favorable for disease development.

Unlike many plant diseases in which stressed trees are more likely to succumb to infection, dense, healthy trees are the most severely affected by white pine blister rust. This is primarily due to the abundance of needle surface area, which provides more sites for spore deposition, and retention of moisture for extended periods, thereby favoring infection. (1).

Infection of pines takes place in late summer-early fall when, in the presence of adequate moisture temperatures below 68.F, basidiospores are released from teliospores on the undersurface of infected *Ribes* leaves (4). The basidiospores are wind disseminated to nearby pines (usually no and more than 900 feet, but in some cases up to one mile or more) and infect through the needle stomata. Yellow-reddish brown spots develop at the points of infection. The fungal mycelium continues to grow down the needle and into the bark of the stem. As the infection progresses, sunken necrotic cankers or spindle-shaped swellings surrounded by an area of yellow-orange discolored bark develop (Fig. 1). During spring and summer the cankers produce blisterlike spermatangia that ooze droplets full of spermatina and then dry. As the canker grows these areas expand. In spring, portions previously occupied by spermatangia produce aecia that appear as sacks or blisters which rupture through the bark and release orange-yellow aeciospores (Fig.2). These spores are wind disseminated over long distances (up to 300 miles) to infect susceptible *Ribes* spp. Following spore release, the blisters persist but the bark in that area dies, leaving characteristic cracked patches. The fungus spreads into the surrounding healthy tissues, continuing the annual sequence of spore generation and bark destruction until it girdles and kills the stem or branch (causing flagging) or the main trunk (leading to death of the tree). An extremely difficult feature of this disease is the 3-6 year lag between infection and diagnostic spore development on pine (1).

Symptoms on the alternate host appear during the summer as small yellow spots on the upper surface of the leaves (Fig. 3). The yellow-orange pustules (uredia) are found on the undersurface of leaves. These structures produce

urediospores that reinfect *Ribes* up to a mile or more away and at the same time intensify the local infection (4). Later in the summer and early fall, brown, hornlike telial structures (Fig. 4) develop. These structures release spores capable of infecting pines within 900-1000 feet and sometimes up to a mile or more. The relative abundance of these structures is a good indicator of the potential blister rust hazard to nearby white pine (4). Initial field inspections should be performed during the diagnostic window from mid-April to early June. Thoroughly inspect susceptible pines for active sporulation (areas where yellow-orange structures have ruptured through the bark) (Fig. 2). Look for off-color, chlorotic, or dead trees, portions of trees, or individual branches. Most actively sporulating trees will exhibit one or more of these features; field inspections, however, have revealed actively sporulating cankers on both branches and main trunks which were devoid of outward symptoms.

If white pine blister rust is confirmed, an intense control regimen should be adopted. With 99% of all blister rust cankers occurring within 9 feet of the ground, nursery and Christmas tree stock is at far greater risk than forest stock, which can be systematically pruned to avoid basal infection without loss of market value (5). With this in mind, all symptomatic cankers should be removed. If branch cankers are observed, prune and destroy the entire branch. When the canker is within 4 inches of the trunk or has invaded the trunk, the tree should be destroyed. Avoid planting susceptible pines in areas where *Ribes* spp. are abundant and the disease is known to occur. If you choose to plant or currently have trees under production in high hazard areas, the alternate host should be destroyed to the greatest extent possible using a properly labeled herbicide. Because white pine blister rust cannot spread without the alternate host, *Ribes*-free zones of 900-1,000 feet surrounding white pine plantings will help minimize the likelihood of infection (3). Trees should not be planted in areas with poor air circulation or that remain cool and damp for extended periods, such as bases of slopes (especially those facing north) and low-lying frost pockets or foggy areas (5). Proper maintenance of weeds and adequate spacing between trees are also important in reducing conditions favorable for disease development.

There are currently no effective chemical controls for the disease. Antibiotic treatments had initially appeared to be successful; however, large scale testing on both eastern and western white pine from 1962 to 1967 revealed that control was inadequate and was therefore discontinued (2).

At the outset, *Ribes* eradication programs were put into place but met with only limited success. In Pennsylvania, as in many northern states where both hosts are native, *Ribes* eradication is not a viable option. White pine blister rust is a disease that will have to be managed (2). While there appears to be some rust resistance in western white pine, there is little evidence of any existing in eastern white pine. Research is continuing in this area, and it is possible that we may eventually see the development of a rust-resistant strain (5). Until then, we will have to rely on intense cultural practices to minimize losses from the disease.

Management will, in some cases, be difficult. While there are no guarantees that you will avoid introduction of this pathogen, steps can be taken to reduce the likelihood of infection as well as your losses by adopting sound crop management practices, developing a keen eye for symptom development, and maintaining an altruistic attitude of sacrificing a few for the benefit of the many.

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1BPI Plant Inspector, Region III, Tunkhannock.
2 Revised 2002, R. Lehman and T. Olson.

Invasive Alien Plant Species of Virginia

Japanese Honeysuckle (*Lonicera japonica*)

For more information, contact the Department of Conservation and Recreation or the Virginia Native Plant Society.

Virginia Native Plant Society
P.O. Box 844, Annandale, VA 22030

Description

Japanese Honeysuckle is a trailing or twining woody vine that can grow to more than 30 feet in length. Young stems are often hairy; older stems are hollow with brownish bark that may peel off in shreds. The simple, opposite leaves are oval to oblong in shape and range from 1.5 to 3 inches in length. In much of Virginia, leaves of Japanese honeysuckle are semi-evergreen and may persist on vines year-round. The extremely fragrant, two-lipped flowers are borne in pairs in the axils of young branches and are produced throughout the summer. Flowers range from 1 to 2 inches in length and are white with a slight purple or pink tinge when young, changing to white or yellow with age. The fruit is a many-seeded, black, pulpy berry that matures in early autumn. Japanese honeysuckle is distinct from our two native honeysuckles, the trumpet honeysuckle (*Lonicera sempervirens*), and wild honeysuckle (*Lonicera dioica*). These natives both bear red to orange-red berries, and their uppermost pair of leaves is joined together.

Habitat

Japanese honeysuckle occurs primarily in disturbed habitats such as roadsides, trails, fencerows, abandoned fields and forest edges. It often invades native plant communities after natural or human induced disturbance such as logging, road building, floods, glaze and windstorms, or pest and disease outbreaks.

Distribution

Japanese honeysuckle is native to eastern Asia. Introduced to cultivation in 1862 on Long Island, Japanese honeysuckle is now widely naturalized in the eastern and central United States. Japanese honeysuckle was, and in some areas still is, planted as an ornamental ground cover, for erosion control, and for wildlife food and habitat. In Virginia, Japanese honeysuckle is naturalized statewide, being most abundant in piedmont and coastal plain forests.

Threats

Where light levels are optimal, such as in forest edges, canopy gaps or under sparse, open forest, newly established Japanese honeysuckle vines grow and spread rapidly. Suppressed vines growing in dense shade, however, are capable of rapid growth and spread when light levels in a habitat are increased by disturbance. In forests, Japanese honeysuckle vines spread both vertically and horizontally by climbing up tree trunks and/or by trailing or clambering over the forest floor and associated vegetation. Trailing vines produce stolons which root when they contact soil, aiding the vegetative spread and persistence of the species. Dense, strangling growths of Japanese honeysuckle can impact desirable vegetation by decreasing light availability within the habitat, depleting soil moisture and nutrients, or by toppling upright stems through the sheer weight of accumulated vines. Negative effects of Japanese honeysuckle invasion include development of malformed trunks in trees, suppression of plant growth, inhibition of regeneration in woody and herbaceous plants, and alteration of habitats used by native wildlife.

Control

Small populations can be controlled by careful hand-pulling, grubbing with a hoe or a shovel, and removal of trailing vines. In old fields and roadsides, twice yearly mowing can slow vegetative spread, however, due to vigorous resprouting, stem density may increase. In pine plantations or in fire-dependent natural communities, Japanese honeysuckle can be controlled by prescribed burning. Burning can greatly decrease the abundance of Japanese honeysuckle within a habitat and limit its spread for one or two growing seasons. Where prescribed burning or mowing is difficult or undesirable, Japanese honeysuckle may be treated with a glyphosate herbicide. Glyphosate is recommended because it is biodegradable and will begin to break down into harmless components on contact with the soil. However, it is nonselective and will affect all green vegetation. Therefore it is best applied to the semievergreen leaves with a spray or wick applicator in late autumn when other vegetation is dormant but Japanese honeysuckle is still physiologically active. Reapplication may be necessary to treat plants missed during the initial treatment. To be safe and effective, herbicide use requires careful knowledge of the chemicals, appropriate concentrations, and the effective method and timing of their application. Consult a natural resource specialist for more information on herbicide use and prescribed burning techniques.

Suggested Alternatives

Some native alternatives to Japanese honeysuckle for use in home landscaping include trumpet creeper (*Campsis radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and trumpet honeysuckle (*Lonicera sempervirens*). Wild ginger (*Asarum canadensis*) makes an excellent ground cover in shady areas. All these species are easy to cultivate, have wildlife and aesthetic value, and can generally be obtained from commercial sources or propagated by wild-collected seeds or cuttings.

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State & Private
Forestry

180 Canfield Street
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File Code: (NA-07-04)
Date: March 9, 2007

Subject: Crider Pine Project

To: Mary O'Brien Reddan, Forest Supervisor
Wayne National Forest

On July 13, 2006, **Rick Turcotte** and **Martin MacKenzie** met with Art Martin, Jason Reed, Chad Fitton, and Gary Dixon of the Wayne National Forest to discuss white pine health and visit several white pine plantations. The pine stands are overstocked and have pockets of pine bark adelgid infestation and bark beetle-related activity. These areas were mapped during 2006 aerial surveys and indicate that insect and disease activity has occurred over many years.

This field discussion resulted in the request for a biological assessment for the Crider Pine Project on the Ironton District. The objectives of this biological assessment were to 1) assess the health of the pine stands, 2) assess current insect and disease activities within the stands, and 3) develop treatment alternatives and recommendations to reduce and/or control current and future insect and disease activity.

There were five, 10 basal area factor prism plots, established in each stand. Twenty five plots for the entire area. Each plot was flagged and the center point GPS (global positioning system) position taken. All "in" trees had their species and D.B.H. (Diameter Breast Height 4.5") recorded. Each "in" pine tree's condition, Alive, Fading (foliage that was off color, red or lime green and is a sign of tree stress), Dead, Defects (multiple leaders, broken tops, multiple stems, or basal damage), Live Crown Ratio, and Insect Activity was recorded. Light readings were recorded for each plot using the AccuPar LP-80 and compared to an instrument recording in an area with full sunlight. A representative dominant and co-dominant pine tree in each stand was increment cored and their heights recorded. Cores were mounted, sanded to make rings more visible and scanned using an Epson 1600 scanner. The scanned images were examined using WinDENDRO 2006a to record number and location of rings. The data was analyzed using WinSTEM 2003d stem analysis software. This provided measurements of incremental diameter growth, cumulative diameter growth, incremental volume growth, and cumulative volume growth for each core. The text files produced by WinSTEM 2003d were imported into Microsoft Excel 2000 to create graphs comparing stands.

Data recorded in the area verified the belief that these stands were overstocked or trending toward an overstocked condition. Mortality tended to be higher in stands with a basal area per acre greater than or equal to 190 square feet. It is likely this trend of increasing stand mortality will continue as trees competition continues and as insect populations take advantage of susceptible trees. This cycle will continue unless some corrective action is taken.

It is recommended that a crown thinning would likely provide the best results for individual tree health and overall stand health. Consideration may be warranted in regeneration



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